Volume 14 Article 55

4-1-1987

Research Notes : United States : An improved greenhouse method of evaluation for inheritance of resistance to race 4 of soybean cyst nematode

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1) An improved greenhouse method of evaluation for inheritance of resistance to race 4 of soybean cyst nematode.

Studies to determine mode of inheritance of resistance to soybean cyst nematode (SCN), *Heterodera glycines*, could be influenced by the methods of evaluation in use. Any improvement in growing conditions of the host and pathogen, superior inoculation techniques, inducement of desirable infection in the host with minimum genetic variability in the SCN population could result in optimum expression of full complement of genes conferring resistance to SCN races.

Our objective was to determine the mode of inheritance of resistance in Soybean Plant Introduction PI 88.788 for SCN race 4 reaction, using the improved techniques of evaluation.

Crosses were made in the field during summer between resistant parent PI 88.788 and susceptible parents 'Peking' and 'Forrest'. The F_1 and F_2 plants were grown in Puerto Rico and University of Missouri-Columbia Delta Center, Portageville, to obtain F_2 and F_3 seeds, respectively. Care was taken to grow plants in fields without SCN infestation.

The F_2 plants, their parents, and a set of standard host differentials, with 'Essex' as susceptible check, were evaluated in the greenhouse. The basic techniques of evaluation and methods for preparation of purified SCN race 4 inoculum were the same as used by Anand and Brar (1983) and Rao-Arelli and Anand (1986).

Some of the improvements include: (1) selection, reproduction of SCN race 4 field populations on susceptible PI line 90.763 for more than 30 generations under isolation in the greenhouse to minimize the existing genetic variability; (2) preparation of inoculum from freshly picked white females found on the roots of PI 90.763 and crushed to release eggs for obtaining synchronized hatching; (3) using inoculum entirely consisting of eggs and placing in direct contact with the host roots for quicker hatching and efficient utilization of all available infestation sites; (4) an aquarium air-blowing pump was used to keep eggs constantly in uniform suspension, so as to dispense approximately same number of eggs in each inoculation.

The reaction of the plants for race 4 is presented in Table 1. The Index of Parasitism (IP) was calculated [(number of cysts on a given PI line/ number of cysts on susceptible, Essex) x 100]. The reaction was expressed positive or susceptible where IP was 10% or more (Golden et al., 1970).

Of the 200 F_2 plants tested from the cross Forrest x PI 88.788, 25 were resistant and 175 were susceptible. The cross of Peking and PI 88.788 segregated 22 resistant:177 susceptible in F_2. The segregation in both crosses could be explained based on two dominant genes and one recessive gene in PI 88.788 conditioning resistance to SCN race 4.

Table 1. Reaction of soybean parents, F_2 plants, host differentials and Essex to *Heterodera glycines* race 4

Entry	Number of plants		Expected ratio	χ^2 value	P value
	Resistant	Susceptible			
Peking	0	10			
Forrest	0	10			
PI 90.763	0	10			
PI 88.788	10	0			
Essex	0	10			
Forest x PI 88.788 (F_2s)	25	175	9(R):55(S)	0.36	.50-.70
Peking x PI 88.788 (F_2s)	22	177	9(R):55(S)	1.47	.20-.30

Several genes conditioning resistance to SCN races were reported in soybean lines Peking, PI 90.763 and PI 88.788 by Caldwell et al. (1960), Hancock et al. (1985), Hartwig and Epps (1970), Matson and Williams (1965) and Sugiyama and Katsumi (1966). Thomas et al. (1975) indicated that resistance to SCN race 4 was conferred by a single recessive gene pair in the cross PI 88.788 x Peking.

The F_2 results obtained in our studies appear to indicate a more complex nature of inheritance for controlling SCN race 4 resistance in PI 88.788. Presumably, the expression of full complement of genes to SCN race 4 in PI 88.788 occurred with the use of some of the improved techniques of evaluation available today. Of course, evaluation of F_3 families would confirm the results obtained in F_2 generations.

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